

gan fishing for Pacific ocean perch in one location (at the southern end of one of the heavy lines, Figure 10). The vessel then traveled to the northern end of the heavy lines, a location popular for obtaining sablefish, and made 5 hauls that were categorized as sablefish targets. The vessel then moved to one of the more southerly locations and fished for Pacific ocean perch, returned to the northern sablefish location, and finished by moving again to the south for northern rockfish. The vessel traveled 120–380 km to obtain sablefish, clearly suggesting that the vessel changed locations specifically to target sablefish, which was allowed under the MRB percentages.

Bycatch of Shortraker–Rougheye Rockfish in the Aleutian Islands

There is no directed fishery for shortraker–rougheye rockfish; however, hauls assigned this target had shortraker–rougheye rockfish as the dominant rock-

fish catch. In total 16 hauls were in this category in 1995 and 17 hauls in 1996, indicating that few hauls were specifically targeting shortraker–rougheye rockfish to the extent that it could be classified as a target. The topping off of shortraker–rougheye rockfish was anecdotally reported in the Aleutian Islands Pacific ocean perch and Atka mackerel trawl fisheries. Only 7 of the 16 shortraker–rougheye rockfish hauls in 1995 were trawl hauls, and no trawl vessel had more than 2 hauls categorized as shortraker–rougheye rockfish target. In 1996, 12 of the 17 shortraker–rougheye rockfish hauls were trawl hauls, and 2 vessels each had hauls designated as shortraker–rougheye rockfish targets 3 or more times.

The hauls from 2 vessels in 1996 were analyzed temporally in a manner similar to that for vessels in the Gulf of Alaska. Individual vessel hauls were sorted by date and haul number, and are presented in a temporal sequence in Figures 11 and 12. Rather than actual catch amounts, the percentage contributions of

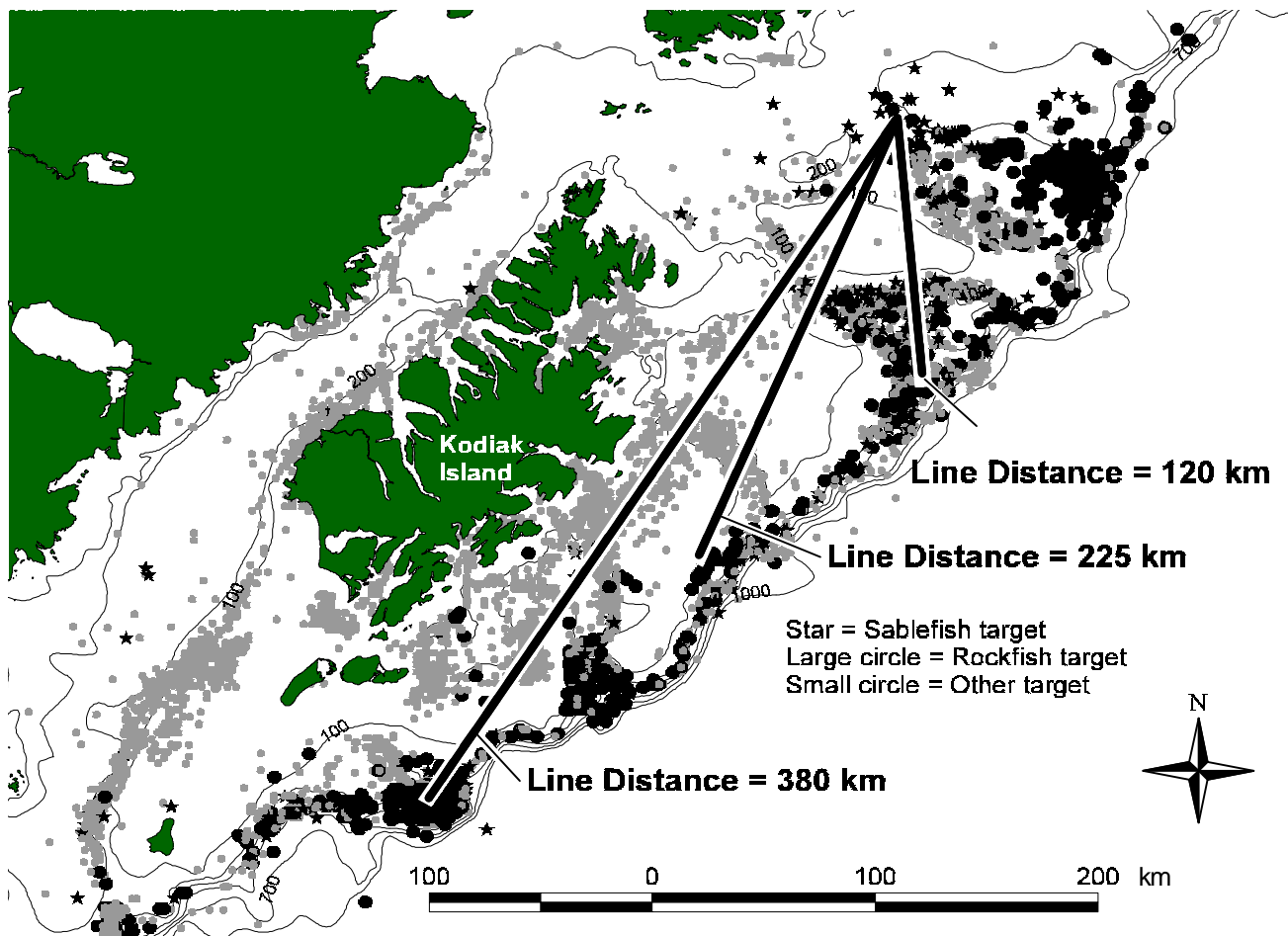
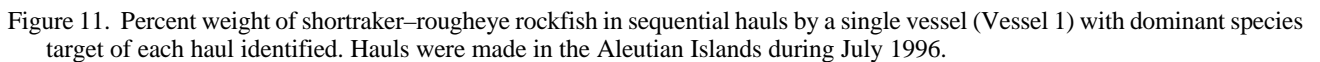


Figure 10. Location of all observed trawl hauls in the vicinity of Kodiak Island during the years 1994–1996. Stars indicate hauls with sablefish as the dominant catch, and large circles denote hauls with rockfish as the dominant catch.



Spatial patterns in the hauls designated as shortraker-rougheye rockfish were not evident. The Aleutian Islands fisheries occur within very limited areas, and fishery hauls under various targets overlap within these areas. Although most of the shortraker-rougheye rockfish hauls (Figure 13) occurred between Attu and Kiska Islands, there were no particular "hot spots" nor were there patterns of spatial shifting to encounter shortraker-rougheye rockfish.

DISCUSSION

Vessels which target rockfish with low natural bycatch rates of sablefish appear to periodically target sablefish. Because sablefish is a valuable product, these vessels apparently take sablefish under the allowable bycatch percentages while fishing for rockfish even when sablefish are not being naturally encountered in the course of rockfish fishing.

Maximum retainable bycatch percentages were not intended to accurately match natural bycatch rates but were implemented to slow harvest rates of a species while providing fishing operations with the ability to retain a reasonable amount of species taken incidentally to directed fishing for a specific target (Sue Salveson, NMFS, Juneau, personal communication). Ideally, MRB percentages do not constrain normal fishing operations but are in place to account for incidental catch and to discourage the harvest of large amounts of species for which directed fishing has been closed. For economic reasons, fishing operations may maximize the catch of valuable non-target species within

the allowable MRB percentages. When there is a large difference between the natural bycatch rates and the MRB allowances, hauls can be specifically directed at the valuable species closed to directed fishing to top off the trip catch with other species up to the MRB allowances.

Within the context of MRBs, we estimated the natural bycatch rates of species groups in the rockfish fisheries of the Gulf of Alaska and in the Pacific ocean perch and Atka mackerel fisheries in the Aleutian Islands. Knowledge of the natural bycatch rates provided a framework to evaluate hauls and identify those with unexpected bycatch rates or fluctuations in target designations over time. Given incentives to top off due to low natural bycatch rates and higher MRB rates, we demonstrated cases of topping-off behavior based on fisheries data.

Similar to other multispecies fisheries (e.g., Babcock and Pikitch 2000), in Alaska's groundfish fisheries the species mix in the catch of an individual vessel during a trip depends upon targeting and discarding decisions, not just the TACs. Within a trip, targets of individual vessel hauls change due to specific targeting practices or to variations in the spatial distribution of fish (Sampson 1997). In our analysis targets were assigned to individual hauls by dominant catch, but MRBs are based on trips consisting of many hauls. An analysis of individual trips would have been useful in identifying patterns in target selection; however, a trip-based analysis is not possible from the fisheries data because trip parameters such as duration of trip, number of hauls, general targeting intentions, and economic considerations are unknown. Therefore, we

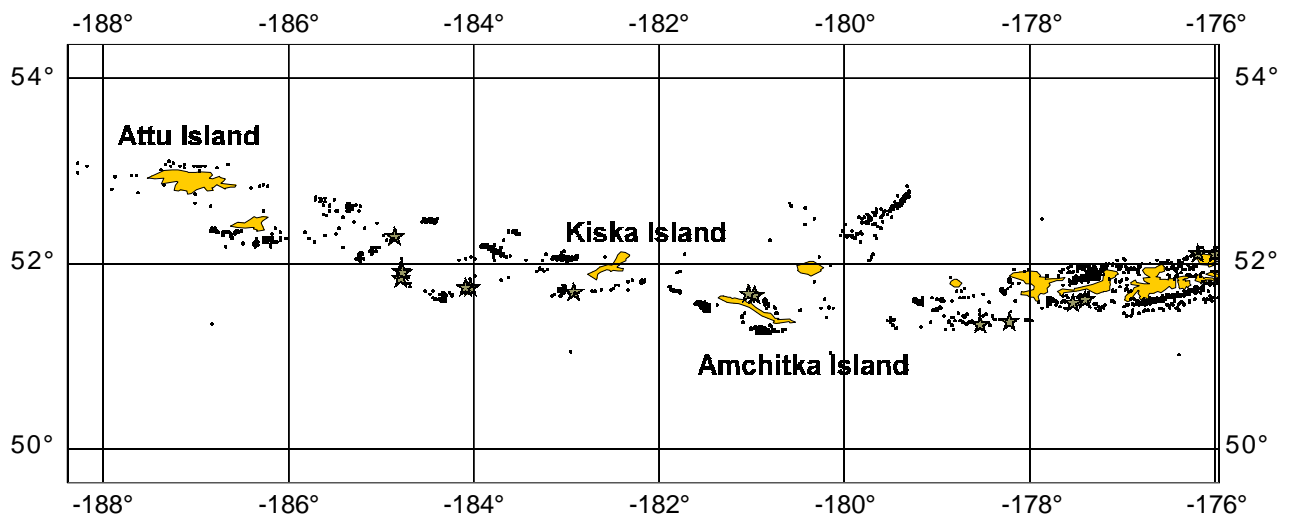


Figure 13. Location of all observed hauls in a portion of the Aleutian Islands during the year 1996. Stars indicate hauls with shortraker-rougheye rockfish as the dominant catch.

examined the sequential pattern in haul targets without categorizing individual trips. The proximity of hauls with low natural bycatch rates to hauls that specifically targeted sablefish, for instance, indicated possible augmentation of the trip catch of sablefish under MRB guidelines. A fishing strategy model similar to that constructed for the multispecies trawl fishery off Oregon and Washington (Babcock and Pikitch 2000) may enable better understanding of the fishing process.

The vessel operator's intended targets were not available to us. Because species complexes overlap spatially, and hauls are usually composed of a mix of species, the intended target of the fishing operation cannot be determined from catch data alone. The added information of both the time the haul was made and the geographic location of the haul were used to illustrate that topping off with sablefish occurs in the Gulf of Alaska rockfish fisheries. A similar analysis of vessels participating in the Aleutian Islands Atka mackerel and Pacific ocean perch fisheries did not show topping-off behavior with shortraker-rougheye rockfish because of extensive overlap of target fishing locations in the Aleutian Islands fisheries.

Historical data are useful in describing bycatch rates and patterns in bycatch in the Alaskan groundfish fisheries. However, several limitations exist in using historical fisheries data to describe the effects of MRB levels. Historical data are collected on a haul-by-haul basis, and are difficult to use to describe or characterize an entire trip or fishing week. Because MRBs are used to cap the retainable bycatch in a fishing week, an examination of individual hauls has limited utility. The observer database can quantify only observed hauls, and no information is available for

unobserved hauls, further confounding the utility of observer data in describing a full fishing week. Another limitation of the observer data is that the total catch for each haul is recorded, but not amount retained, whereas MRBs apply to retained catch only. A major caveat is that historical data were collected from fisheries that were prosecuted under MRBs. Given that it is not possible to know if a haul target was selected to constrain bycatch, or at the opposite extreme, to top off up to the allowable MRB level, the data have limitations in describing either avoidance or topping-off behavior. The Pacific ocean perch fishery in the Aleutian Islands, for instance, operated under an MRB of 15% in 1995 and 1996. This may have provided an incentive to top off on other more valuable rockfish species, such as shortraker or rougheye rockfish. However, it is very difficult to distinguish the top-off hauls from hauls that would normally encounter shortraker-rougheye rockfish.

In target fisheries where the TAC is set well below the allowable biological catch, or where stock concerns are not a problem, the similarity between the MRB and the natural bycatch rate is not of great concern. However, when there is demand or competition for a stock that may be affected by unexpected or undue fishing pressure, the difference between the MRB and the natural bycatch rate may warrant inspection, and a change in the MRB to more closely reflect natural bycatch rates might be desirable. Based on our analyses, some MRB percentages in 1997 were reduced by the North Pacific Fishery Management Council to minimize topping-off behavior, and to minimize the risk of exceeding the TAC (1997 Council Newsletters available at <http://www.fakr.noaa.gov/npfmc/default.htm>).

LITERATURE CITED

- Babcock, E. A., and E. K. Pikitch. 2000. A dynamic programming model of fishing strategy choice in a multispecies trawl fishery with trip limits. *Canadian Journal of Fisheries and Aquatic Sciences* 57:357–370.
- Kinoshita, R. K., A. Greig, and J. M. Terry. 1998. Economic status of groundfish fisheries off Alaska, 1996. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-85.
- Heifetz, J., and D. Ackley. 1997. Bycatch in rockfish fisheries in the Gulf of Alaska. Report to the North Pacific Fishery Management Council. Available from U.S. Department of Commerce, NOAA, NMFS, Auke Bay Laboratory, 11305 Glacier Highway, Juneau, Alaska 99801.
- Pautzke, C. G. 1996. Management perspectives on waste and discards in North Pacific fisheries. Pages 269–273 in *Solving bycatch: considerations for today and tomorrow*. Alaska Sea Grant College Program Report 96-03, Fairbanks.
- Sampson, D. B. 1997. Predictability of groundfish catch rates and species mix in the United States west coast trawl fishery. Pages 46–47 in *Fisheries bycatch: consequences and management*, Dearborn, Michigan. Alaska Sea Grant College Program Report 97-02, Fairbanks.
- Seber, G. A. F. 1982. The estimation of animal abundance. Charles Griffin and Company, Ltd., London.
- Witherell, D., and C. Pautzke. 1997. A brief history of bycatch management measures for eastern Bering Sea groundfish fisheries. *Marine Fisheries Review* 59(4):15–22.

The Alaska Department of Fish and Game administers all programs and activities free from discrimination based on race, color, national origin, age, sex, religion, marital status, pregnancy, parenthood, or disability. The department administers all programs and activities in compliance with Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972.

If you believe you have been discriminated against in any program, activity, or facility, or if you desire further information please write to ADF&G, P.O. Box 25526, Juneau, AK 99802-5526; U.S. Fish and Wildlife Service, 4040 N. Fairfax Drive, Suite 300 Webb, Arlington, VA 22203 or O.E.O., U.S. Department of the Interior, Washington DC 20240.

For information on alternative formats for this and other department publications, please contact the department ADA Coordinator at (voice) 907-465-4120, (TDD) 907-465-3646, or (FAX) 907-465-2440.

